availability of investment capital. In other words, long-run forward-looking costs must account for all the "micro-decisions" a firm has made and is likely to make over a long-term planning horizon. If a cross-section of the firm's activity at any given time is taken, the result of all of these small decisions can be seen, *i.e.*, the firm will have a mix of older and newer technologies, and some equipment will have high utilization rates whereas other equipment will have lower rates. This does not mean, however, that the firm is inefficient; indeed, the contrary is true, for this "technology mix" is part of the firm's overall solution to the cost minimization problem.

D. A New Entrant In The Telecommunications Market Will Face The Same Long-Run "Cost Minimization Problem" That Incumbents Face.

A firm entering the telecommunications market will be more efficient than an incumbent only if it solves the fundamental business "cost minimization problem" better, over time, than the incumbent does. For example, better forecasting would reduce the cost of uncertainty, and exclusive access to a new technology might reduce the indivisibility problem. But there is nothing inherent in being an entrant that would automatically allow one firm to solve the "cost minimization problem" better than an incumbent. This conclusion is apparent in comparing how a new entrant and an incumbent firm would "optimize" with respect to the cost factors discussed above:

1. The entrant will start with zero demand, and will have to plan to grow rapidly in order to gain a level of output that would utilize its plant efficiently and sustain its business plan.

2. The entrant will be affected, as is the incumbent, by changes in technology and input prices. Although the incumbent may have older vintages of

equipment in place, the effects of input price changes will have been reflected as an expense of owning those vintages in previous periods. It should not affect the incumbent's forward-looking cost, which would include the depreciated value of older plant.[31]

3. The indivisibility problem will be, if anything, greater for the entrant, because it must place some minimum size of plant to get started, but will only acquire customers to fill that capacity over time. Certainly the entrant cannot place capacity to serve 100% of the market, as the proxy models assume, and utilize that plant at a very high level on day one. In a competitive market, in which no firm is likely to serve all of the demand, it is possible that no firm -- incumbent or entrant -- will be able to realize the scale economies that the incumbent has today.

4. The entrant will not have less uncertainty than the incumbent faced when it was the sole provider. As customers gain a choice of local provider, all local carriers -- incumbents and entrants alike -- will face greater uncertainty because of customer "churn" among providers. Each carrier will have to predict not only the secular growth in total demand, but also its market share.[32] If anything, the entrant -- having no basis on which to forecast -- may face a more difficult

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[31] Once the entrant invests in equipment, it too will experience economic depreciation of that equipment, which is a cost all providers must reckon with over the long run.

[32] Experience in the long distance market shows that the more competitive the market became, the more likely customers are to move from one to the other. This added to the uncertainty faced by IXCs -- and to their marketing and customer service expenses.

forecasting problem than the incumbent. Certainly the assumption of 100% market share, which the BCPM and Hatfield 3 models both implicitly make, would not be a reasonable demand forecast for an efficient entrant. Further, once entry has occurred, both entrant and incumbent will face risks from unanticipated changes in input prices or in technology.

In sum, when estimating forward-looking cost it is unreasonable to simply ignore the real cost drivers discussed here: growth, indivisibility, changes in technology, input prices and uncertainty. These are all factors that contribute to the long-run cost envelope, and ignoring them is as fatal to accurate cost estimates as leaving out some components of the network, such as drops or pair gain devices. Further, these real costs will affect an efficient entrant at least as much as they would an incumbent.

E. The Cost Models Do Not Estimate Forward-Looking Costs Correctly.

The cost proxy models being considered by the Commission do not reflect the dynamic "cost minimization problem" existing in the real-world and do not take into account factors such as growth, indivisibilities, changes in input prices, and uncertainty. These models, then, necessarily fail to set the appropriate long-run, forward-looking costs.

In discussing the estimation of forward-looking costs, parties have tended to focus on how the models happen to be built, and have implicitly assumed that this somehow reflected something about the underlying cost concept. But the models do not actually reflect any well-defined cost concept. They do not estimate a solution to the problem of minimizing cost over time; indeed they do not optimize anything, but simply follow rules of thumb.

The results of these models therefore do not represent "efficient" networks. Indeed, they may implement network designs that would be quite inefficient. For example, building a network all at once from scratch appears, based on the models, to result in low costs. In fact, placing all network capacity at once is generally not the solution to the "cost minimization problem" -- if all the costs the model ignores were considered, it would become apparent that this is actually a high-cost network. Similarly, replacing all network investment every time input prices changed would actually lead to very high costs over time. Raising fill factors in any of the proxy models will always appear -- according to the model -- to reduce the cost. This must be so because the model does not consider any of the tradeoffs the firm must take into account in solving the "stair step" problem. In fact, there is some optimal level of fill, and some increment to capacity for each "step," that will minimize cost over time. Raising utilization beyond this level in real life will increase costs.[33]

F. The Commission Is Considering Using Cost Models For A Purpose For Which They Were Never Intended.

Even more fundamentally, simulation models -- like the proxy cost models have traditionally been used in the industry and by regulators for an application entirely different from the one the Commission now proposes, namely, to estimate cost relationships that are not readily observable by looking at accounting measures. Specifically, cost models have been used to estimate incremental costs for small

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[33] Note that this myopia makes the models very open to manipulation. If these were really optimizing models, then putting extreme input values into them would raise costs, not lower them. In the proxy models, which do not consider cost tradeoffs, it is easy to make costs appear to be low by selecting the inputs.

increments in demand. For this purpose, it has not been necessary for the model to simulate the entire cost function, but only to estimate the slope of the function close to the point where the firm is actually operating. For information about the level of the cost function – total, or average cost – as opposed to its slope, companies and regulators have properly relied on accounting data.[34]

In this traditional use of simulation models, the possibility of error has been limited by two factors. First, the amount of extrapolation involved is extremely limited. The model takes the current operation of the firm as a base, and moves only a small increment from that starting point. Second, any error can only affect estimates of cost relationships, rather than cost levels. The firm's overall recovery level is not determined by the model, but instead is set by some accounting cost measure, by price caps, or by some other means.

The use of a simulation model the Commission is considering here is entirely different. In this application, the Commission would use a "bottoms-up" model to estimate the average level of cost, and not just the slope associated with small increments around a known point. This cost level will be used to set the average, uniform price for a product which represents the greater part of the firm's business. To do this with a simulation model without reference to accounting data, it is necessary for

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[34] The average cost will be the slope of a ray from the origin to the point at which the firm is operating. This is the cost the current cost models estimate. TSLRIC is the average cost across an increment, where the increment is the entire service. The current cost models do not do this. But even if they did, when the service being evaluated represents a preponderance of the firm's output, the estimation process is essentially trying to simulate the entire production function of the firm – especially when, to determine the price, shared and common costs must also be considered.

the model to simulate the entire production function from the origin. The model must extrapolate over a very large interval, with a very small base of information, namely, the location of the existing switch nodes, some engineering rules of thumb, and some input prices. This creates new and unprecedented opportunities for error, and constitutes a misuse of this type of model.

For the many reasons described in these Comments and elsewhere by many other parties, proxy cost models will never be perfect. Nonetheless, GTE has supported the development of such a model for a limited use in the universal service context because it is the only method by which the Commission can obtain information on the relationship of costs across small geographic areas. Because homogeneity of cost within each universal service area is necessary for the success of the plan, and because all of the available information suggests that costs vary widely across relatively small geographic areas, GTE agrees that any cost-based estimate of universal service support should be done on the basis of small geographic units. This represents a valid use of a simulation model to generate information about cost relationships that would not be observable by the use of actual cost data alone.[35] However, the universal service plan should be structured to avoid reliance on the cost models to estimate overall cost and price levels.

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[35] Because of its many deficiencies, the Hatfield model is not suitable even for this limited purpose. The Hatfield model's many problems are set forth in the two independent reports that accompany GTE's comments. The first report was prepared by NERA and analyzes Hatfield Model Version 2.2.2. The second was prepared by INDETEC and analyzes the recently released Hatfield 3. Both these reports confirm that the Hatfield model is fundamentally flawed and thus should not be used to determine universal service support, or the prices for access charges or unbundled network elements.

G. Cost Models Must Be Carefully Validated And Differences From Actual Costs Carefully Explained.

The fact that cost proxy models cannot and do not accurately estimate long-run, forward-looking costs can further be established by comparing the costs produced by the model to a carrier's actual costs. Although AT&T, MCI and others argue that actual costs are irrelevant to forward-looking costs, in fact, forward-looking costs are related to actual costs. Consider the simple example of a static world where technology does not change, input prices remain the same, and demand remains constant. In such a world, a firm's forward-looking costs would always be equal to its embedded costs. As changes in technologies and input prices occur, however, differences between embedded and forward-looking costs become possible, but these differences will take place over time, and these differences should be explainable.

As the firm seeks to minimize costs over time, its embedded costs are simply a record of its efforts to optimize in past periods. It is reasonable to expect that in future periods it will continue to move along the same long-run cost function. Unless there is some sharp, fundamental discontinuity in the underlying process, there is no reason to expect that costs in the near future will be dramatically different. There is certainly no basis in the record for the Commission to assume that such a discontinuity is just about to occur.

Thus, actual costs can, and should, be used to validate an estimate of forward-looking costs. If the differences between these costs cannot logically be accounted for and explained, then the cost models must be wrong. As evidenced in the many State arbitration proceedings, the Hatfield Model produces forward-looking costs that are

about 40% lower than GTE's costs. There are only a few possible explanations for this startling difference:

First, the depreciation of GTE's assets on its regulated books has not captured the true economic depreciation of those assets. The value of embedded investment declines over time as a result of wear and tear, obsolescence, or a fall in input prices. If this change in value is correctly recognized as it occurs, then it should be counted as an expense related to the ownership of these assets during the year in which they lost value. If this economic depreciation had been applied in prior years, then the current net value of GTE's embedded plant should be consistent with what it would cost to buy new equipment to do the same thing.[36]

Where GTE and other ILECs were required to use regulatory-prescribed depreciation schedules instead of realistic economic life spans, then there will be an amount attributed to net investment on the ILEC's books that is actually a underrecovered expense from previous periods. This amount of underrecovered

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[36] *See* GTE's *D.96-45* Comments at 28-29 (December 19, 1997). *See also Christensen Evaluation* at 7-8. In another recent study, Rohlfs, Jackson and Richardson state that "[i]f regulatory depreciation had been adequate, embedded net plant and the economic value of plant would be approximately the same. Put another way: [w]hen intervenors or regulators draw sharp distinctions between forward-looking and embedded capital costs, they implicitly acknowledge the seriousness of the capital recovery problem." Jeffrey H. Rohlfs, Charles L. Jackson and Ross M. Richardson, "The Depreciation Shortfall" ("*SPR Study*"), USTA's *D.96-262* Comments, Attachment 15, at 10 (January 29, 1997).

depreciation expense could explain the difference between an ILEC's embedded cost and a reasonable estimate of forward-looking cost.[37]

Second, a change in input prices is another possible reason for a difference between embedded and forward-looking costs. However, this possibility will be captured, in large part, if economic depreciation is correctly applied. To see this, it is useful to distinguish between inputs that are related to capital and those that are not.

A change in input prices related to capital investment, such as the prices of equipment, would be included in depreciation, if economic depreciation has been permitted by regulators. This also holds for any capitalized expense, such as the labor involved in placing equipment.

Some other expenses may not themselves be capitalized, but may be determined, in part, by the mix of capital. Such expenses might include maintenance required by certain equipment, or consumption of electric power. Any change in the input prices for such items would also be captured in economic depreciation.[38] Consider, for example, a used car that requires frequent maintenance; its value would

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[37] GTE has recommended that this depreciation shortfall be amortized over a five year period and recovered through a non-access related recovery program. Also, this amount should be removed from the ILEC's net investment for the purpose of calculating the cost estimate used to develop high-cost support. *See* GTE's *D.96-45* Comments at 25-32 (December 19, 1996). GTE has estimated the amount of this deferred expense on its books at $7.1 billion. *See* GTE's *D.96-262* Comments at 39-40 (January 29, 1997).

[38] Note that this would also include changes in the quantity of the maintenance or other input required.

be lower than that of a similar car which required less maintenance, and would decline when parts or service prices went up.

Any expense that is not related to capital will change quickly when the prices of the inputs -- such as labor -- change. Therefore, the current actual cost of the firm already incorporates any recent changes in these input prices. It is not clear why the Commission should assume a sudden discontinuity in the level of these expenses. GTE will discuss *infra* its proposal that forward-looking expenses should be estimated using commonly accepted forecasting methods.

Third, AT&T, MCI and others claim that GTE and other incumbent LECs were inefficient, made imprudent investments, and "gold-plated" their networks, resulting in overstated embedded investment. The problem with this argument, however, is that no party has introduced credible evidence in this record or in any of GTE's 50-plus State arbitration proceedings that suggests GTE has been inefficient or imprudent. This is not surprising, given that GTE has always operated under close regulatory supervision designed to encourage efficiency and prudent investment decisions.

Until 1990, GTE and other incumbent LECs operated under rate of return regulation, the principal purpose of which is to ensure that regulated firms are given an opportunity to earn no more than a reasonable rate of return on prudently incurred investment. Although parties have, from time to time, claimed that regulated firms engage in "gold-plating" under rate of return regulation (known as the "Averch-Johnson effect"), econometric studies have failed to demonstrate such an effect.

Since 1990, GTE and the larger incumbent LECs have operated under price cap regulation for interstate services, and many states have adopted similar forms of

incentive regulation for intrastate services. This type of regulation is designed to ensure that incumbent LECs have an incentive to maintain and improve their efficiency. Indeed, the Commission's own price cap plan includes a productivity offset that is based on the finding that incumbent LECs have been successful in improving productivity at a more rapid rate than that of firms in other industries.[39] Therefore, there is absolutely no evidence to support the claims of the Hatfield sponsors that incumbent LECs are inefficient or that their embedded investments were imprudently incurred.[40]

Fourth, and finally, the cost proxy models are erroneous. After accounting for economic depreciation, this is the only logical explanation and the only explanation supported by the record. As discussed above, the cost proxy models do not correctly represent the "cost minimization problem" faced by firms and do not consider important factors that contribute to cost. The models are simplifications of the real-world; this means that real-world data contain vital information the models lack. Thus, simulation

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[39] Indeed, the very same parties who argue in this proceeding that ILECs are inefficient have argued just the opposite in the Commission's price cap and access reform proceedings: that there are large productivity improvements which the Commission should recapture through its price cap plan. *See, for example*, MCI's *D.96-262* Comments, at n.40 (January 29, 1997), reference to an *ex parte* of the CARE Coalition: "Total Factory Productivity (TFP) studies ... show that the LECs have been able to achieve interstate productivity of as much as 9.9 percent over the last five years." CARE Coalition *Ex Parte* Comments, CC Docket No. 94-1 ("*D.94-1*"), Price Cap Performance Review for Local Exchange Carriers (April 16, 1996).

[40] As discussed *supra*, it is possible that one firm, faced with the same cost minimization problem, will solve it better than another firm, and thus will be more efficient *ex post*. But when seeking to estimate forward-looking cost, the Commission has no basis for assuming *a priori* that any one firm will be more efficient than another. For exactly the same reason, the Commission cannot simply assume that entrants, as a group, will be more efficient than incumbents are today.

models are inherently unreliable as estimators of average cost levels. Further, many of the hard-wired and default user-adjustable inputs contained in the models are simply wrong. This issue is summarized in Section II *infra* and is discussed in detail in the attached reports evaluating Hatfield 2.2.2 and Hatfield 3.

H. If The Estimates Used To Set Prices Are In Error, The Development Of An Efficient Competitive Market Will Be Harmed.

It is imperative that the cost estimate used to determine universal service support (or access prices or unbundled network element prices) reflect as closely as possible the market price to avoid distorting market entry decisions, innovation and investment. For example, if it were possible for a new firm to produce services at a lower cost through some innovation, then the surest way to prevent this efficient entry would be for the regulator to attempt to guess the entrant's cost and then order the incumbents to sell at a price equal to that guess.[41] As Kahn notes: "first, that is not how the competitive process works; and second, its prices would actually discourage competitors coming in and building their own facilities . . . ."[42] Instead, setting the

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[41] In connection with a press conference with Vice President Gore, it was recently reported that "the F.C.C. tried to jump-start the rivalry by forcing the Bell companies to give the long-distance carriers and other potential rivals access to their local networks on favorable terms." *Emphasis added.* Lander, Mark, "Instead of a Flood of Competition, the Communications Act Brought a Trickle;" The New York Times, February 10, 1997, at C7. The Times then suggests AT&T and MCI, as well as the cable networks, have shown less enthusiasm than expected for seeking to compete directly with the ILEC networks. The story fails to connect that lack of enthusiasm to the "favorable terms." The best way to ensure that a competitive network will not be constructed is to compel ILECs to provide services at "low ball" prices, simply because rational firms will not choose to construct facilities to compete with incumbents compelled to provide services and facilities below cost.

[42] *Kahn Letter* at 2.

current price at the level of the incumbent's cost "gives challengers the proper target at which to shoot, the proper standard to meet or beat, and the proper reward if they succeed. If they can achieve costs lower than that, they will enter and in the process (which the FCC's pricing rules would short circuit) beat prices down to efficient levels."[43]

Moreover, if the Commission should underestimate the entrant's cost, the damage to the competitive process would be even greater. In such a case, the Commission would create a significant risk of a market crisis or "train wreck." If the price is seriously underestimated, no entrant would choose to supply, and the incumbent could not continue to supply for any length of time.

I. The Use Of A Proxy Cost Model For Universal Service Should Be Limited.

The following comments examine the use and purpose of cost proxy models in the context of universal service, given the Commission's pending *D.96-45* decision. For the reasons discussed previously, it is certain that any cost estimate produced by a cost proxy model will fail to accurately reflect the actual cost of providing universal service, and thus will fail to provide a reliable estimate of the market price. Therefore, in the context of universal service, the Commission must design its plan to mitigate the errors inherent in the cost models.

GTE proposes that the cost estimate for any small geographic area being considered for high-cost support (such as a Census Block Group or "CBG") should be

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[43] *Id. See also Staff Analysis* at 9 ("If market prices exceed forward-looking costs, new competitors will efficiently enter the market and bring pressure to bear on the prices").

formed by combining information on actual cost (to set the overall cost level for each study area) with information from a proxy model (to determine the relative level of cost in the geographic area being considered). While it is important to make the proxy models as accurate as possible, because of their lack of ability to optimize and their failure to consider growth, significant errors will always remain. It is reasonable, therefore, to expect that while some of the difference between the proxy output and actual cost will be explainable, it will not be possible to reconcile the entire difference. That is to say, the output of the proxy model will never provide satisfactory estimates, because the model will never predict the actual costs accurately. It is therefore most important that the Commission design its universal service plan to be robust with respect to such errors. GTE proposes two mechanisms that would accomplish this objective:

First, when the model disagrees with reality, the plan should accept reality. This means simply that the plan should be designed to use the proxy models to provide information about cost relationships, but should not rely on them to estimate cost levels. As GTE has suggested in its previous *D.96-45* comments, this can be done by using the proxy estimates to distribute actual costs for each study area to the CBG level.[44]

Second, a competitive bidding process should be established as part of the universal service plan. Bidding will provide a market-based mechanism for correcting

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[44] *See* GTE's *D.96-45* Comments, December 19, 1996 at 56-57 and GTE's *D.96-45* Reply Comments, January 10, 1997, at 23-28.

any errors that, despite the Commission's best efforts, may find their way into the cost estimate-based support amounts.[45]

J. None Of The Current Cost Models Correctly Measure The Costs Of A Narrowband Network That Would Provide Currently Accepted Quality Levels. (¶ 10)

The Staff states "that a model for pricing services and unbundled network elements should, at a minimum be able to estimate the full stand-alone cost of the minimum set of network elements capable of delivering traditional voice telecommunications service and narrowband data services." GTE recommends that in the context of universal service, the models should focus on the delivery of narrowband services. However, the *Staff Analysis* (at ¶ 10) raises at least two issues:

First, what standard should be assumed for "narrowband" services to be modeled? This assumption will, in turn, affect the rules of thumb used for facility provisioning in the model. The *Staff Analysis* assumes that the network will be able to provide both voice and data services at "currently acceptable quality levels" for both voice and private line applications. This assumption does not appear to be entirely consistent with the relatively narrow bandwidth specified for basic local service in the *D.96-45 Recommended Decision*. Nor, in GTE's view, will the rules of thumb used in the Hatfield 3 model result in quality levels that would be acceptable for transmitting data over the switched network, or for accessing the Internet, and certainly not for private line services.

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[45] *See*, Statement of Paul R. Milgrom, filed as Attachment 1 to GTE's *D.96-45* Comments In Response To Questions, August 2, 1996.

GTE recommends that the models should engineer a narrowband network that is fully capable of providing "currently acceptable quality levels" for data applications using either switched or private line services. However, the *D.96-45 Recommended Decision* appears to assume quality levels that the basic service definition, as it stands, would not supply.[46] For example, the Joint Board bases its decision not to support advanced information services, in part, on the premise that customers can access the Internet and information services generally using the basic local service, together with the subscriber's own modem.[47] Certainly, with modems currently in widespread use today at speeds of 33 kbps or higher, and 56 kbps modems becoming readily available,[48] the limited bandwidth specified by the *D.96-45 Recommended Decision* would not provide customers with the capability for effective Internet use.[49] Similarly, the engineering assumptions in the Hatfield 3 model that call for very long copper loops incorporating

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[46] The Joint Board limits the bandwidth of the definition of universal service to "the frequency range between approximately 500 Hertz and 4,000 Hertz, for a bandwidth of approximately 3,500 Hertz." *See Recommended Decision* at ¶ 48.

[47] *Id.* at ¶ 69.

[48] *See,* "New Modems Are Fast, Cheap, Incompatible," Wall Street Journal, February 11, 1997, at B1.

[49] *See, Recommended Decision* at ¶ 48. The approximately 3,500 Hertz bandwidth recommended by the Joint Board would typically support the use of only a 9600 kbps modem. This speed would not be very satisfactory for Internet access use. The Hatfield 3 model attempts to correct the most serious loop design flaw of Hatfield 2.2.2 by adding loading coils, thereby limiting loops to this same bandwidth, and failing to provide the service quality that customers have come to expect. However, Hatfield 3 incorrectly designs long loops. It fails to include the costs of necessary voice and signaling equipment required to meet minimum transmission standards, and exceeds the maximum distance a digital loop carrier ("DLC") can serve. *See* Attachment B, at 9-10.

load coils would not provide service quality sufficient to support these uses of the narrowband network. Since millions of customers use their basic local service to access the Internet today, it would appear to be necessary to accommodate this use if the network is to provide "currently acceptable" quality. Note that the issue of providing adequate bandwidth and transmission quality to meet customers' expectations for narrowband service is a separate matter from the provision of broadband services.

Second, none of the proxy models being considered performs the analysis described in the *Staff Analysis* at ¶ 10. They do not perform a stand-alone analysis of basic local service, since they consider demand for other services.[50] However, they also do not perform a stand-alone analysis of all narrowband services, because not all such services are included in the models. Neither exercise would correspond to a TSLRIC analysis, which the proxy models do not do either.[51]

Further, as discussed *supra*, the ability of any model to represent the necessary conceptual experiment correctly is highly suspect. The point is simply that none of the available proxy models estimates any clearly defined cost concept. It is thus inappropriate to ascribe to the model estimate the properties associated -- rightly or wrongly -- with either TSLRIC or stand-alone costs.

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[50] Of course, a stand-alone analysis of basic local service would yield a higher cost estimate.

[51] To estimate the TSLRIC of basic local service, the model should compare the cost of producing all of the services the firm offers with the cost of producing all services except basic local service. None of the proxy models do this.

K. A Single Cost Proxy Model Cannot Be Used For Multiple Objectives. (¶ 11)

Building a single model for use in pricing access, unbundled network elements and universal service would not be a simple matter, even if based on identical underlying network components. This is the case because such a model would have to incorporate two different sets of algorithms for dealing with shared production costs. That, in turn, is because costs shared by unbundled network elements are different than those shared by services, and/or are not shared in the same proportion. Moreover, the proper relationship between the TELRICs of unbundled network elements and the TSLRICs of services that are composed of network elements is not a simple summing. That would imply that there were no shared costs in the production of network elements, which is not true.

The models proffered to date, including the new BCPM and Hatfield 3, are really only capable of rendering relative cost estimates of the highly unrealistic, static, hypothetical network examined -- that is, identifying areas with higher costs than other areas. Thus, the Commission cannot use these models to prescribe the actual price level for any service or network element.

Further, a network designed to be optimally efficient for one purpose may not be optimal for another. For example, the *Staff Analysis* (at ¶ 37) mentions that the Hatfield 2.2.2 model assumes that DLCs are integrated into the switch, and that its sponsors claim their use is consistent with current ILEC practices. When considering complete services, in many cases the most efficient method of providing local loops is

through use of integrated DLCs.[52] However, when determining the least cost of an unbundled loop that will not be used in conjunction with ILEC switching, integrated DLCs are very inefficient because additional investments are needed.[53] Thus, a model that properly estimates the cost of a service may mis-estimate the cost of discrete network elements, and *vice versa*.

L. Cost Model Inputs And Cost Estimates Must Be Consist With Independent Evidence And Be Capable Of Verification. (¶¶ 12-15)

GTE strongly agrees that the proxy models should be verified against independent evidence. This can occur on several levels.

First, it should be possible to evaluate the reasonableness of model inputs, such as input prices. Many of the commonly used material prices are not proprietary, and it should be possible to obtain independent observations of these values. However, for certain vendor-confidential input prices which vendors have sought to protect, GTE agrees with the suggestion made by the *Staff Analysis* (at ¶ 15) that proprietary values for these inputs could be used, provided they are subject to evaluation by third parties.

Second, the engineering inputs and rules of thumb used in the models should also be verifiable. It certainly is not true, as some parties have suggested, that the

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[52] There are many variables that must be considered when choosing the most efficient loop provisioning method for a particular location. These include: distance from central office; anticipated growth rate; availability of support infrastructure; and the forecasted mix of voice service, data, and digital services.

[53] "One way to unbundle an individual loop from an I[ntegrated] D[igital] L[oop] C[arrier] is to use a demultiplexer to separate the unbundled loop(s) prior to connecting the remaining loops to the switch." *Local Competition Order* at ¶ 384. *See also,* GTE's *D.96-98* Comments, , at Attachment 1 (May 16, 1996), for a discussion of the additional equipment that is needed.

different results produced by the models are entirely explained by differences in input values; the results will also be sensitive to the way each model is structured. USTA has engaged a consulting engineer to perform an evaluation of the BCPM and Hatfield 3 models, and comparison of the models will help to reveal how differences in model structure affect the results. The *Christensen Evaluation* makes such a comparison between BCM2 and Hatfield 2.2.2. GTE agrees that, to make such analysis possible, the underlying equations, inequalities, and identities which comprise the model should be publicly available, and that the sources of all input and parameter values should be documented.[54]

Third, as the *Staff Analysis* recognizes, the most important validation exercise is to compare the model's output to actual data. This effort can take two forms: the Staff can examine various intermediate outputs of the model, and compare them with actual observations of similar items. For example, physical measures of network investment, such as loop length, number of loops, and the total route miles, should be compared with comparable measures of actual networks in place. (*Staff Analysis* at ¶ 14) GTE discusses *infra* a comparison of Hatfield 2.2.2 outputs with actual data from a sample of GTE serving areas. This exercise is a useful step in checking the reasonableness of the model in general, and would help the staff to better understand the aspects of each model's structure that may lead to the most significant errors. Perhaps most

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[54] Testimony in state arbitration proceedings has revealed that Hatfield Associates does not have any internal work papers to back up the equations contained in the version 2.2.2 spreadsheets. Testimony of Robert E. Mercer, Hatfield Associates, Deposition, Docket Nos. 16300 & 16355, Tr. at 63-64 (Texas Public Utility Commission, October 24, 1996) ("Mercer Texas Deposition"). A copy of the pertinent pages were attached to *GTE's D.96-98 Opposition.*

importantly, analysis of this kind would help to identify where the models err in estimating the relative levels of cost across small units of geography. This verification of cost relationships is more difficult to do by direct comparison to actual cost, since accounting cost information may not be disaggregated at the small area level.

However, the most important verification effort of all is to ensure that the overall level of cost predicted by the model is correct. The only way to do this is to compare the model's cost estimates to the actual cost experienced by ILECs. The *Staff Analysis* (at ¶ 13) proposes that the models should be compared to ILEC actual cost as reported through the ARMIS process. GTE strongly agrees. This comparison should be performed at the level of aggregation for which ARMIS data are available, which is the study area. The *Staff Analysis* also notes (*id.*) several possible explanations for any differences in cost that might be observed.[55]

The results of this validation process can be used to better understand the models, and to try to improve them. However, the price estimate that the Commission ultimately adopts must be reasonable, which is to say that it must be consistent with the actual cost of the ILECs. For reasons described in these comments and amply documented elsewhere in the record, the models will not accurately predict the actual cost level. Therefore, the Commission, when it adopts a mechanism for estimating the

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[55] *See also* GTE's *D.96-45* Comments, at 28-29 (December 19, 1996). Note that, as explained *supra*, underdepreciation as a result of technological change discussed as item (1) in ¶ 13 of the *Staff Analysis*, should not exist if the ILEC's plant had been correctly valued through economic depreciation in past periods. Note also that item (3) in ¶ 13, a change in input price, should also be captured by economic depreciation.

market-determined price of basic local service in its universal service plan, should structure its plan to be robust with respect to any such model error. This means that the plan should be designed to ensure that the price level assumed for basic local service should fairly reflect actual costs.

M. Cost Models Must Have The Flexibility To Reflect Local Conditions. (¶ 16)

GTE agrees that local conditions should be reflected in a proxy model.[56] Not only should it be possible to utilize state-specific data in place of national average data in the models, but it should be possible to utilize company-specific data within states as well.[57]

The need for the ability to permit a user to vary model inputs arises not only because, as the *Staff Analysis* suggests, individual states may wish to use the model. In the context of the Federal universal service plan, it is important that the cost estimates used should accurately reflect differences in cost across CBGs, and across companies. For reasons discussed *infra*, it is unlikely that the model can be structured in such a way as to allow a single set of inputs and parameter values to yield accurate results for all areas. This problem may be alleviated by modifying the structure of the

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[56] For example, the mixture of buried and aerial cable may vary considerably due to terrain, and this mix must be accommodated by a model. The Hatfield 2.2.2 model uses unsupported "default" values, and therefore fails to meet this criterion. *See* Testimony of Daniel Kelley, Hatfield Associates, Docket No. 96-329, Tr. at 560 (Hawaii Public Utility Commission, October 17, 1996), attached to *GTE's D.96-98 Opposition*, Attachment D, at 2.

[57] *See* Mercer Texas Deposition at 63-66, attached to *GTE's D.96-98 Opposition*, Attachment B, at 6, describing the Hatfield 2 model's reliance upon default values, rather than state- or company-specific values.

model; however, it may also be necessary to stratify the inputs, using values which are state-specific or study area specific.

II. GTE'S SPECIFIC RESPONSES AND SUGGESTIONS REGARDING THE MODEL STRUCTURE AND INPUT REQUIREMENTS OF COST PROXY MODELS.

The following sub-sections respond to specific questions or discuss tentative conclusions contained in the *Staff Analysis* within paragraphs 17-73. These responses are arranged in the same sequence as the *Staff Analysis*.

A. Existing Wire Center Locations Should Be Used To Estimate ILEC Costs Because They Reflect Optimization Of Many Factors Not Considered By Cost Models. (¶¶ 18-21)

The *Staff Analysis* (at ¶ 18) notes that the *Recommended Decision* proposes to use cost models that rely upon existing ILEC wire center locations. The current location of ILEC switches reflects an optimization by the companies with respect to many factors, most of which are not observed by the models. Data on current network nodes thus supply the models with important information that they could not obtain any other way. It is possible that a given ILEC may not have optimized perfectly in some cases, or that circumstances have changed in some way that the company has not yet fully reflected. It does not follow from this, however, that the Commission could determine an alternative set of switch locations that would be more efficient than the current ones, using the available proxy models, or any model.

The choice of switch node locations is one of the most difficult problems in network design. Given the point-to-point traffic demand among all the locations to be served, an optimal tradeoff must be made between switching and transport to minimize costs, serve all the demand, and meet quality standards. As the number of locations to

be served becomes large, this problem becomes extremely complex.[58] Even the most sophisticated planning models do not solve these problems fully; they make significant simplifying assumptions, and can indicate solutions for limited sets of customers and nodes. Further, these models cannot consider all of the relevant variables, such as proximity to concentrations of customers, zoning laws, the availability and price of buildings or land, and the locations of obstacles such as highways, rivers, lakes, or mountains. Selection of the location of network components must therefore involve the use of planning tools by experienced engineers and managers who are familiar with local conditions and can supply the information the models lack. Note also that the same considerations with respect to dynamic optimization apply here: network designers must consider expected future demand, and plan for the development of the network over time in response to changes in technology and input prices.[59]

None of the proxy cost models that have been offered thus far are capable of doing any optimization. They therefore do not provide even a starting point for selecting optimal switch locations. Even if they did attempt to optimize, they contain only the most limited information about network demand, and locate customers only

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[58] It is, in effect, a "traveling salesman" problem.

[59] Note that what is optimal over time may not appear to be optimal in a static sense. The same tradeoffs with respect to embedded equipment, described *supra*, apply here with special force because switch locations will be expensive to change once switches are placed and feeder plant is embedded around them. The set of switch nodes that would be optimal for the entrant -- in the static sense -- to serve the demand it will have in its first year will certainly not be the same as the ones that would be optimal to serve entrant's demand fire years later. The entrant cannot vary its switch locations freely during the planning period, any more than the incumbent can.

within the limits of their units of observation. Clearly, it would not be possible to develop models whose optimization capabilities are any different in time to meet the May, 1997 target date established by the 1996 Act.[60] More importantly, even as a long run matter, it simply is not reasonable to think that the Commission could develop a single national model which could be run for 200,000 CBGs, without the benefit of any intervention by experts with detailed local knowledge, that would produce a solution to this complex problem that is "better" than the one reached by thousands of ILEC engineers and managers. Accordingly, it is not correct to assume that the current set of switch locations are suboptimal because there is no evidence to support such an assumption. Further, there is no evidence that they are suboptimal compared to any other set of locations the Commission might adopt.

In considering the possibility of changing the switch node assumptions, in particular the need for a switch in every wire center, the *Staff Analysis* (at ¶ 20) appears to rely on assumptions regarding future network design that are not accurate. It is true, as is clear from data reported to the FCC, that ILECs are already substituting large numbers of remotes for what used to be stand-alone switches. From this the Staff appears to assume that it will be more efficient in the future to have fewer, and larger, switches. This does not necessarily follow. As Hausman has reported, IXC networks have employed larger switches as a consequence of developments in optical fiber technology and digital switching. But that has not happened in the ILEC industry because local network design is influenced by a different set of factors than an IXC

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[60] 47 U.S.C § 254(a)(2).